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Resistance of Field (Dent) Corn Hybrids to the Southern (Cotton) Root Knot and Reniform Nematode

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Prior to 1970, corn was considered a non-host of the southern root-knot nematode (*Meloidogyne incognita)*. Even today, reference to corn as an effective rotation alternative for southern (cotton) root-knot nematode (RKN) can be found in extension literature nationwide. Unfortunately, all corn hybrids on the market today apparently are good hosts for southern RKN and will maintain if not increase their populations rather than suppress them. It is believed that resistance to the southern RKN was lost over the years because plant breeders failed to screen corn breeding lines against southern RKN.

A southern RKN resistant corn hybrid is badly needed to help avoid aggravating already serious nematode problems in cotton, soybean, and many vegetable crops. For example, cotton production throughout the South is threatened by both the reniform nematode (*Rotylenchulus reniformis*) and the southern (cotton) RKN. While corn is a non-host for the reniform nematode and can be used successfully as a rotation partner to effectively manage this nematode in a cotton production system. However, cropping corn before cotton can greatly increase the risk of sizable yield losses in cotton due to southern RKN, particularly in fields with lighter soils. The only alternative rotation partner for cotton growers with southern RKN problems is peanut, which is a non-host to both the reniform and southern RKN. However, peanut production is not only limited to certain soils but the availability of costly harvesting equipment, and marketing options. Therefore, peanut is not a viable option for many Alabama cotton producers.

This study focused on identifying corn hybrids that are resistant to the reniform (*R. reniformis*) and southern root knot nematode (*M. incognita*). Corn hybrids selected were based on availability of those hybrids suitable for cultivation in the south.

Materials and Methods

Greenhouse evaluation of corn hybrids for resistance to the southern root knot nematode (*Meloidogyne incognita* race 3) and reniform nematode (*Rotylenchulus reniformis*) were conducted at the Plant Science Research Center of Auburn University. Ninety-two transgenic and non-transgenic corn hybrids were evaluated for host suitability to both nematodes species and compared to a nematode susceptible cotton standard DPL 555 BG/RR.

Inoculum preparation: Reniform nematodes were collected from various cotton field locations across Alabama and the southern root knot nematode originated from the Auburn University, E. V. Smith Research Center. Reniform and southern root knot nematodes were propagated and increased on cotton (ST 5599BG/RR and DPL 555BG/RR, respectively) in the greenhouse. After sixty days, cotton plants were removed and the each nematode species was extracted separately from the soil by combined gravity screening and sucrose centrifugal floatation. Nematode eggs were collected from the root systems by shaking the excised root systems for 4 minutes in 0.6% NaOCl and sieving. Both nematode species were standardized to 1000 juveniles or vermiform life stage and eggs per 2 ml of water for inoculation.

Host suitability: Separate evaluations were conducted for each nematode species. Corn hybrids were grown in 150cm^3 Conetainer® filled with a loamy sand soil (72.5% sad, 25% silt, 2.5% clay, ph 6.4). The soil was autoclaved twice at 121°C and 103.4 kPa for two hours on two consecutive days. Seeds were planted and allowed to germinate and grow for five to seven days after which the hybrids were inoculated with the standardized solutions of each nematode species.

Greenhouse experiments were arranged in a randomized complete block design with five replications and each test was conducted twice. Sixty days after inoculation, nematodes were extracted from the soil, and eggs were removed from the roots as previously described. After enumeration of reniform vermiform and egg populations, reproductive factor values (Rf = final population / initial population) were determined. Any RF values over 1 would indicate the nematode species is increasing in population numbers. Nematodes are not reproducing when the RF values are less than 1.

All data was analyzed using general linear model procedures (GLM) of SAS. Means were separated with Fisher's protected least significant difference test ($P \leq 0.05$).

Results and Discussion

We are in the process of screening current and discontinued corn hybrids for signs of RKN resistance in the greenhouse (Table 1). So far, none of the corn hybrids screened exhibit any resistance to southern RKN. Increases in southern RKN populations as well as considerable root galling were noted for all corn hybrids tested. All the corn hybrids screened for resistance to the reniform nematode are resistant to the nematode and do not allow for reproduction of this nematode species. More hybrids are being screened. Until a corn hybrid with good resistance to RKN is identified, corn SHOULD NOT BE grown in fields with established populations of the southern RKN.

Table 1. Corn hybrids evaluated for the reniform nematode (*Rotylenchulus reniformis*) and southern root knot nematode (*Meloidogyne incognita* race 3) susceptibility in the greenhouse.

Company	Corn Hybrid	R. reniformis RF	Rating	M. incognita RF	Galling Index	Rating
AgraTech	AT 695 RRCRW	nt[z]	nt	10.8	5	S
AgraTech	AT 719 RR CRN	0[y]	R[x]	nt	nt	nt
AgraTech	AT 755 RR	0	R	nt	nt	nt
AgraTech	AT 755 RRBT CRN	0	R	3.06	5	S
AgraTech	AT X41655	0	R	nt	nt	nt
AgraTech	AT X41751 CRN	0	R	nt	nt	nt
Croplan Genetics	CG 721 RR2/BT	0	R	nt	nt	nt
Croplan Genetics	CG 731 HX/LL	0	R	1.8	5	S
Croplan Genetics	CG 751 RR2/BT	nt	nt	8.46	5	S
Croplan Genetics	CG 780 RR2/BT	nt	nt	2.52	5	S
Croplan Genetics	CG 799 RR2	nt	nt	3.34	5	S
Croplan Genetics	CG 823 HX/LL	0.09	R	nt	nt	nt
Croplan Genetics	CG 851 RR2/BT	0	R	12.78	5	S
Croplan Genetics	CG DS 822 RR2/BT	0.05	R	nt	nt	nt
Croplan Genetics	CG DS 830	0	R	nt	nt	nt
Croplan Genetics	CG 799 BT	0	R	nt	nt	nt
Croplan Genetics	CG 895 BT	0	R	4.5	5	S
Dekalb	DKC 57-84 YGCB	0.03	R	nt	nt	nt
Dekalb	DKC 58-80 RR2/ YGCB	0.03	R	nt	nt	nt
Dekalb	DKC 61-22 RR2	nt	nt	8.46	5	S
Dekalb	DKC 61-45 RR2/ YGCB	0	R	12.78	5	S
Dekalb	DKC 61-72 RR2	0	R	6.48	5	S
Dekalb	DKC 62-31 YGCB	nt	nt	3.96	5	S
Dekalb	DKC 63-81 RR2/ YGCB	0	R	11.34	5	S
Dekalb	DKC 64-27 RR2	nt	nt	5.22	5	S
Dekalb	DKC 64-81 YGCB	nt	nt	5.04	5	S
Dekalb	DKC 66-21 YGCB	0	R	nt	nt	nt
Dekalb	DKC 66-23 RR2-YGCB	nt	nt	14.4	5	S
Dekalb	DKC 67-23 RR2-YGCB	nt	nt	3.24	5	S

Company	Corn Hybrid	R. reniformis RF	Rating	M. incognita RF	Galling Index	Rating
Dekalb	DKC 67-60 RR2	0.03	R	17.46	5	S
Dekalb	DKC 69-68 RR2-YGRW	nt	nt	18.9	5	S
Dekalb	DKC 69-71 RR2/ YGCB	0	R	6.3	5	S
Dekalb	DKC 69-72 RR2	0	R	3.24	5	S
Dyna Gro	DG 57P12	nt	nt	9	5	S
Dyna Gro	DG 58P59	0.01	R	nt	nt	nt
Dyno Gro	DG 58K02	nt	nt	6.3	5	S
Dyna Gro	DG 58K22	0.02	R	nt	nt	nt
Dyna Gro	DG 58K40	0	R	5.22	5	S
Dyna Gro	DG 58P45	nt	nt	2.16	5	S
Dyna Gro	DG 58P59	nt	nt	21.06	5	S
Dyna Gro	DG CX 04219	0.04	R	nt	nt	nt
Dyna Gro	DG CX 04319	0	R	nt	nt	nt
Dyna Gro	DG CX 05415	nt	nt	6.84	5	S
Dyna Gro	DG CX 05516	0	R	nt	nt	nt
Dyna Gro	DG CX 06319	nt	nt	0.9	5	S
Garst	GARST 8200	0	R	nt	nt	nt
Garst	GARST 8225 RR	0	R	nt	nt	nt
Garst	GARST 8246	nt	nt	7.92	5	S
Garst	GARST 8247 YGI	nt	nt	16.74	5	S
Garst	GARST 8248 RR	nt	nt	3.062	5	S
Garst	GARST 8288	0	R	nt	nt	nt
Garst	GARST 8292 YGI	0	R	nt	nt	nt
Garst	GARST 8295 YGI/RR	nt	nt	14.94	5	S
Garst	GARST 8350 YGI	0	R	nt	nt	nt
Garst	GARST 8353 CB/LL	nt	nt	5.4	5	S
Garst	GARST 8380 IT	nt	nt	13.86	5	S
Garst	GARST 8450 IT	0	R	6.3	5	S
Pioneer	PION 31D58	nt	nt	10.98	5	S
Pioneer	PIONEER 31G66	0	R	nt	nt	nt
Pioneer	PIONEER 31G68 YGCB	0	R	4.68	5	S
Pioneer	PIONEER 31G97 RR2	0	R	nt	nt	nt
Pioneer	PIONEER 31N26 RR2	0	R	6.12	5	S

Company	Corn Hybrid	R. reniformis RF	Rating	M. incognita RF	Galling Index	Rating
Pioneer	PIONEER 31N28	nt	nt	8.82	5	S
Pioneer	PION 31P41	nt	nt	1.8	5	S
Pioneer	PIONEER 31R87 RR2	0	R	6.48	5	S
Pioneer	PIONEER 33H25	0.01	R	nt	nt	nt
Pioneer	PIONEER 33M54	0.03	R	19.2	5	S
Pioneer	PIONEER 33V15	0	R	5.22	5	S
Pioneer	PION 33Y45	nt	nt	3.96	5	S
Southern States	SS804	0.03	R	8.1	5	S
Southern States	SS746 RR2/YGCB	0	R	nt	nt	nt
Southern States	SS842 RR2/YGCB	0	R	1.8	5	S
Southern States	SS 96012	nt	nt	4.14	5	S
Southern States	SS 96013	nt	nt	5.94	5	S
Terral	TV 2160 BT (YGCB)	0.01	R	nt	nt	nt
Terral	TV 23R31 (RR)	0	R	nt	nt	nt
Terral	TV 25BR23 (RR/ YGCB)	0	R	5.22	5	S
Terral	TV 25R31 (RR)	0	R	8.28	5	S
Terral	TV 26B82 (YGCB)	0	R	nt	nt	nt
Terral	TV 26BR41 (RR/ YGCB)	0	R	3.78	5	S
Terral	TV 26BR61	nt	nt	1.8	5	S
Terral	TV 27C48	0	R	nt	nt	nt
Terral	TVX 25BR601	nt	nt	2.1	5	S
Terral	TVX 25 BR602	nt	nt	12.78	5	S
Vigoro	VIGORO V 58YR2	0	R	2.88	3	S
Vigoro	VIGORO V 59YR52	0.03	R	nt	nt	nt
Vigoro	VIGORO V56Y51	0	R	nt	nt	nt
Vigoro	VIGORO V62R66	0	R	24.48	4	S
Cotton	DPL 555 BGRR	6.6	S	1.26	5	S

[z]nt = not tested.
[y]RF = numbers over 1 indicate the nematode population is increasing.
[x]S = susceptible, MS = moderately susceptible, MR = moderately resistant, and R = resistant.